CLAIMS

What is claimed is:

1. A method for establishing a coarse-grained reservation of a lightpath traversing a plurality of connected lightpath segments between source and destination nodes in an optical switched network, comprising:

making a soft reservation of node resources supporting respective lightpath segments from among the plurality of lightpath segments, the soft reservation of the node resources corresponding to a scheduled time period for which the lightpath is requested to be reserved;

determining if adequate node resources are available for reservation during the scheduled time period to support traversal of the entire lightpath; and

making a hard reservation of the node resources corresponding to the scheduled time period if adequate node resources are determined to be available.

2. The method of claim 1, wherein the optical switched network comprises a photonic burst switched (PBS) network.

3. The method of claim 2, wherein the optical burst switched network comprises a wavelength-division multiplexed (WDM) PBS network.

4. The method of claim 1, further comprising storing resource reservation data at each node, including resource reservation status indicia indicating whether a resource has a corresponding soft or hard reservation.

5. The method of claim 4, further comprising:

passing a resource reservation request message between the nodes connected to the lightpath segments in a downstream traversal of the lightpath, the resource reservation request message including resource reservation information;

extracting the resource reservation information from the resource reservation request message;

determining, based on existing resource reservation data for a given node, whether adequate resources are available during the scheduled time period; and

making a soft reservation for a node resource the resource is determined to be available for the scheduled time period.

6. The method of claim 5, wherein the resource reservation request message includes a generalized multi-protocol label-switching (GMPLS)-based label defining transmission parameters for a lightpath segment to which the GMPLS-based label corresponds.

7. The method of claim 6, wherein the GMPLS-based label includes at least one field identifying an input wavelength employed for carrying signals over a lightpath segment identified by the GMPLS-based label.

8. The method of claim 5, wherein the resource reservation request message comprises a *Path* message having a format based on an extension to the RSVP-TE (ReSerVation Protocol – Traffic Engineering) signaling protocol.

9. The method of claim 5, wherein the resource request information includes data defining the scheduled time period.

10. The method of claim 5, further comprising:

passing a resource reservation response message between the nodes coupled to the lightpath segments in an upstream traversal of the lightpath, the resource reservation request message including resource reservation response information;

extracting, at each node, the resource reservation response information from the resource reservation response message; and

changing, at each node, the soft reservation for the node resource to a hard reservation.

11. The method of claim 10, wherein the resource reservation response message comprises a *Resv* message having a format based on an extension to the RSVP-TE (ReSerVation Protocol – Traffic Engineering) signaling protocol.

12. The method of claim 1, further comprising:

building a list of potential lightpaths between the source and destination nodes;

selecting a first potential lightpath in the list;

determining if sufficient resources are available to reserve node resources supporting lightpath segments defined by the first potential lightpath for the scheduled time period; and

processing a next potential lightpath in the list to determine if sufficient resources are available to reserve node resources supporting lightpath segments defined by the next lightpath for the scheduled time period if it is determined that resources supporting the lightpath segments of the first potential lightpath are insufficient; and

repeating the previous operation for subsequent next potential lightpaths in the list until either a lightpath having sufficient resources is identified or the list is exhausted.

13. The method of claim 12, further comprising prioritizing the potential lightpaths in the list based on at least one transmission-related criteria.

14. The method of claim 13, further comprising dynamically reprioritizing the potential lightpaths in the list in response to a detected change in network transmission conditions.

15. The method of claim 13, wherein the potential lightpaths are prioritized based on traffic balancing considerations.

16. The method of claim 13, further comprising dynamically reprioritizing the potential lightpaths in the list in response to a detected change in network topology.

17. The method of claim 12, wherein the determination of whether adequate resources are available at a given node comprises:

aggregating any existing reservations for the node resource corresponding to a specified bandwidth and the scheduled time period to obtain an existing resource allocation;

adding the bandwidth percentage corresponding to a resource reservation request to the existing resource allocation to obtain a requested allocation for the node resource;

determining if the requested allocation exceeds a threshold.

18. The method of claim 1, wherein a partial use of a node resource may be reserved.

19. The method of claim 18, wherein the partial use comprises a bandwidth percentage use of a lightpath segment.

20. A switching apparatus for use in an optical switched network, comprising:

optical switch fabric, having at least one input fiber port and at least one output fiber port; and

a control unit, operatively coupled to control the optical switch fabric, including at least one processor and a first storage device operatively coupled to said at least one processor containing machine-executable instructions, which when executed by said at least one processor perform operations, including:

receiving a resource reservation request from a first node, said resource reservation request including data pertaining to a first lightpath segment between the first node and the switching apparatus, which comprises a second node, and a

scheduled time period for which resources for the switching apparatus are requested to be reserved; and

making a soft reservation of resources supporting communication via the first lightpath segment for the scheduled time period;

receiving a reservation response; and

changing the soft reservation of the resources supporting communication via the first lightpath segment to a hard reservation to commit the resources for the scheduled time period.

21. The switching apparatus of claim 20, wherein execution of the instructions further performs the operation of storing resource reservation data on one of the first storage device or a second storage device operatively coupled to said at least one processor, said resource reservation data including resource reservation status indicia indicating whether a resource has a corresponding soft or hard reservation.

22. The switching apparatus of claim 20, wherein the optical switched network comprises a photonic burst switched (PBS) network.

23. The switching apparatus of claim 22, wherein the optical switched network comprises a wavelength-division multiplexed (WDM) PBS network; and the optical switching fabric provides switching of optical signals comprising different wavelengths carried over common fibers that may be respectively coupled to said at least one input fiber port and said at least one output fiber port.

24. The switching apparatus of claim 20, wherein the resource reservation request message includes a generalized multi-protocol label-switching (GMPLS)-based label defining transmission parameters for the first lightpath segment.

25. The switching apparatus of claim 20, wherein the resource reservation request message comprises a *Path* message having a format based on an extension to the RSVP-TE (ReSerVation Protocol – Traffic Engineering) signaling protocol.

26. The switching apparatus of claim 20, wherein the resource reservation response message comprises a *Resv* message having a format based on an extension to the RSVP-TE (ReSerVation Protocol – Traffic Engineering) signaling protocol.

27. The switching apparatus of claim 20, wherein execution of the instructions further performs the operations of:

extracting a location of a third node coupled to the switching apparatus via a second lightpath segment from the resource reservation request; and

forwarding the resource reservation request to the third node.

28. The switching apparatus of claim 20, wherein execution of the instructions further performs the operations of:

determining if sufficient resources are available to support communication via the first lightpath segment for the scheduled timeframe; and

generating an error message if it is determined that there are not sufficient resources available.

29. The switching apparatus of claim 20, wherein said at least one processor includes a network processor.

30. The switching apparatus of claim 20, wherein said at least one processor further includes a control processor.

31. A machine-readable medium to provide instructions, which when executed by a processor in a switching apparatus comprising a first node in an optical switched network, cause the switching apparatus to perform operations comprising:

receiving a resource reservation request from a second node, said resource reservation request including data pertaining to a lightpath segment between the second node and the switching apparatus and a scheduled time period for which resources for the switching apparatus are requested to be reserved to support communication via the lightpath segment;

determining if resources are available to support communication via the lightpath segment during the scheduled time period, and if so,

making a soft reservation of resources supporting communication via the first lightpath segment for the scheduled time period;

receiving a reservation response; and

changing the soft reservation of the resources supporting communication via the first lightpath segment to a hard reservation to commit the resources for the scheduled time period.

32. The machine-readable medium of claim 31, wherein execution of the instructions further performs the operations of:

storing resource reservation data on a storage device operatively coupled to the processor, said resource reservation data including resource reservation status indicia indicating whether a resource has a corresponding soft or hard reservation.

33. The machine-readable medium of claim 31, wherein execution of the instructions determines whether adequate resources are available at a given node by performing operations including:

aggregating any existing reservations for the node resource corresponding to a specified bandwidth and the scheduled time period to obtain an existing resource allocation;

adding the bandwidth percentage corresponding to a resource reservation request to the existing resource allocation to obtain a requested allocation for the node resource; and

determining if the requested allocation exceeds a threshold.

34. The machine-readable medium of claim 31, wherein the optical switched network comprise a wavelength-division multiplexed (WDM) photonic burst switched (PBS) network.